FACULTY OF TECHNOLOGY

EMPLOYEE HEALTH AND WELL-BEING IN THE CIRCULAR ECONOMY CONTEXT – A SYSTEMATIC LITERATURE REVIEW

Md Mehedi Hasan Tusher

INDUSTRIAL ENGINEERING AND MANAGEMENT

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ABSTRACT

Employee health and well-being in the circular economy context – a systematic literature review

Md Mehedi Hasan Tusher

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Supervisors at the university: Arto Reiman, Jukka Majava

In this era of high global business competition and resource depletion, the call for a new economic model is getting louder. In such a condition, the concept of circular economy (CE) has gone one step further to analyze its potentiality to address the recent business and economic sustainable developments and thus gained strong ground for adoption. In addition to the material resources, human labor is, indeed, an important input for the production process of products or services. However, there has been little study made on human labor or human factors as vital resources in the context of the circular economy. The purpose of this review is to explore how human issues are considered in the circular economy context by studying the existing literature. Thus, the focus is on employee well-being, occupational safety & health, employment issues, and human resource management. PRISMA tool was used for the systematic review. The review of articles shows that human issues were not directly the topic of interest for most of the researchers studying the perspectives of a circular economy. However, some issues related to this thesis came up in their studies. Thus, the current literature indicates the fact that the existing abilities of the employees, their skills, policies for workplace safety, and employee health issues are not in compliance with the progressive trend of CE adoption by different industries. In these regards, special employee training to build required skills, specific workplace safety measures, strong policies and regulations by government and other authorities are recommended to incorporate in circular business model to pursue the true effectiveness of circular economy.

Keywords: Ergonomics, Circular Economy, Human Factors, Human Resources Management, Occupational Safety and Health, Sustainability.

FOREWORD

This thesis is a part of the master's degree in Product Management at the University of Oulu. The main purpose of this thesis is to explore the review of the current literature to know the human-related issues like employee health, safety, and wellbeing in a circular economy context. I formally started the thesis in February and completed writing in July 2021. It was an amazing experience completing the thesis. In addition to learning the relevant topics of the thesis, I learned a lot about academic writing. The thesis topic introduced me to different industries going through or planning transition to the circular economy business model. I would like to express of heartily gratitude to all the individuals involved in helping me complete the thesis in time.

I, especially want to convey sincere thanks to my supervisors Mr. Arto Reiman and Mr. Jukka Majava for their patience and understanding throughout the process. Regular meetings and their sincere guidance helped me a lot in understanding my progressing actions and finally reaching all the way to the conclusion. The thesis being a review I used a lot of literature: I am thankful to the authors.

I am grateful to my parents, siblings, and lovely wife for their unwavering support during the study tenure. I finally would like to thank the University of Oulu for sharing the lovely experience with me.

Oulu, July 19, 2021
Md Mehedi Hasan Tusher

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LIST OF ABBREVIATIONS

CE	Circular Economy
CVDs	Cardiovascular Disorders
DALY	Disability-Adjusted Life Year
EMAF	Ellen MacArthur Foundation
GDP	Gross Domestic Product
HF	Human Factors
HF/E	Human Factors or Ergonomics
HR	Human Resource
HRM	Human Resource Management
IEA	International Ergonomics Association
ILO	International Labour Organization
IT	Information Technology
ITSM	Information Technology Service Management
MSDs	Musculoskeletal Disorders
PRISMA	Systematic Reviews and Meta-Analyses
RQ	Research Question
SMEs	Small and Medium-sized Enterprises
TBL	Triple Bottom Line
UNEP	United Nations Environment Programme
WRD	Work-Related Diseases

1. INTRODUCTION

1.1 Background of the study

In this era of high global business competition and resource depletion, the call for a new economic model is getting louder. The world is observing vast development in recent decades and efforts to have new concepts of developments are there all the time (Reike et al., 2018). Developments to be sustainable in resource performance, business is exploring new ways to reuse or restore products or their components, energy, and labors involved. In such a condition, the concept of circular economy has gone one step further to analyze its potentiality to address the recent business and economic sustainable developments and thus gained strong ground for adoption. In addition to the material resources, human labor is, indeed, an important input for the production process of products or services. However, there has been a little study made on human labor or human factors as vital resources in the context of the circular economy. Though there has been vast discussion about the circular approach of resource management, human factors are not well addressed in circular ways (Hans, 2021).

"A circular approach to the labor market can make employees more productive over their working life and enhance their happiness at work " (Hans, 2021). However, humans not being materials resources, making labor circular and sustainable is much more complex. New and innovative skills are considered to be required for current labor markets to cope up with the emerging circular economy perspective (Hans, 2021). Moreover, employee health, employee wellbeing, and occupational safety are expected to be major issues with the changing business trend to the circular economy. This study is an effort to know how current literatures address this issue and point out future challenges. Though the basic concept of circular economy is the same for all economic aspects, it has different approaches for different industrial sectors. An effort has also been made to identify how the major industries consider the human factors in a circular economy context.

1.2 Research objective and questions

The purpose of this review to explore how human issues are considered in the circular economy context in the literature. In this regard, current literature were studied to learn more how humans as employees are considered in this context. Thus, the focus is on

employee well-being, occupational safety and health, and also on employment issues and human resource management.

To conduct the review and explore the objectives of the thesis the following research questions (RQs) were set:

RQ1 How are human factors considered in the circular economy context?

RQ2 How are human factors discussed in different major industries along with their scopes in the CE perspective?

The first question is mainly a theoretical analysis of current studies where the focus is to know the literature that discusses human factors related issues in the circular economy.

The second question focuses on the major industries in specific to know their current scenarios to deal with the human factors issues and human resources management.

1.3 Research structure

The research is conducted in two major phases:

1. Literature Review
2. Analysis and Discussion

The literature review is mainly the theoretical studies of the previous research and review related articles and reports. The literature review covers the topics like the conceptual ideas about the circular economy, sustainability, human resources management, a short description of systematic literature review processes adopted along the results of the search in different angles. The second phase of the thesis is the analysis and discussion of the reviews to find out the results and scopes for the industries.

2 LITERATURE REVIEW

2.1 Circular economy and sustainability

Though the circular economy and sustainability are not entirely new concepts, they are increasingly gaining more attention from academics, industrial sectors, and policymakers (Brennan et al., 2015). However, despite their conceptual importance and unique appeals, the similarities, differences, and relationships are not often made explicit in the literatures which results in blurring the potentiality of their real conceptual contours and constrains the efficacy of using the approaches in research and practices (Geissdoerfer et al., 2017). Hence, before exploring our thesis discussion it is important to study the topics of circular economy and sustainable development on a conceptual basis.

The following section provides a brief introduction to the two major concepts addressed in this thesis: sustainability and the circular economy. Studying firstly with the former and concluding with the latter, this section shorty explores the historical origins of the concepts, compares and synthesizes some of the definitions, and discusses the related issues.

2.1.1 Sustainable development

Sustainable development is increasingly getting popular and being incorporated into both the agendas of strategic business companies and policymakers (Geissdoerfer et al., 2017). Economic activities and development always have a different side of negative impacts on our planet. Though, the world's economy is getting emancipation through the intense business competition and thus developments are seen obvious, an emerging concern is now the sustainability of those development activities in the long run as they have significantly negative impact on earth like warming up atmospheric temperature (Lash, et al., 2007).

The term sustainability derives from the French word *soutenir* meaning "to hold up or to support" (Brown et al., 1987) and modern origin is in forestry (Von Carlowitz, 1713). However, later it was directed to the context of ecology where addressing the ability of nature and maintaining development at a certain level is the prime concern (Mantel, 1990).

Johnston et al. (2007) found around 300 definitions of sustainability. These definitions mainly focus on the development by human activities with the mention of concern for the

global-scale environmental risks like biodiversity loss, climate change issues, disruption in the nitrogen cycle, depletion of ozone layers, etc. According to Geissdoerfer et al. (2017) the most accepted definition was provided by Brundtland Commission as "sustainable development is the development without compromising the future generation's ability to meet their own needs with addressing the needs of the present" (Brundtland, 1987).

According to the United Nations Environment Programme (UNEP, 2011), sustainable development has three pillars: economic, social, and environmental (see Figure 1).

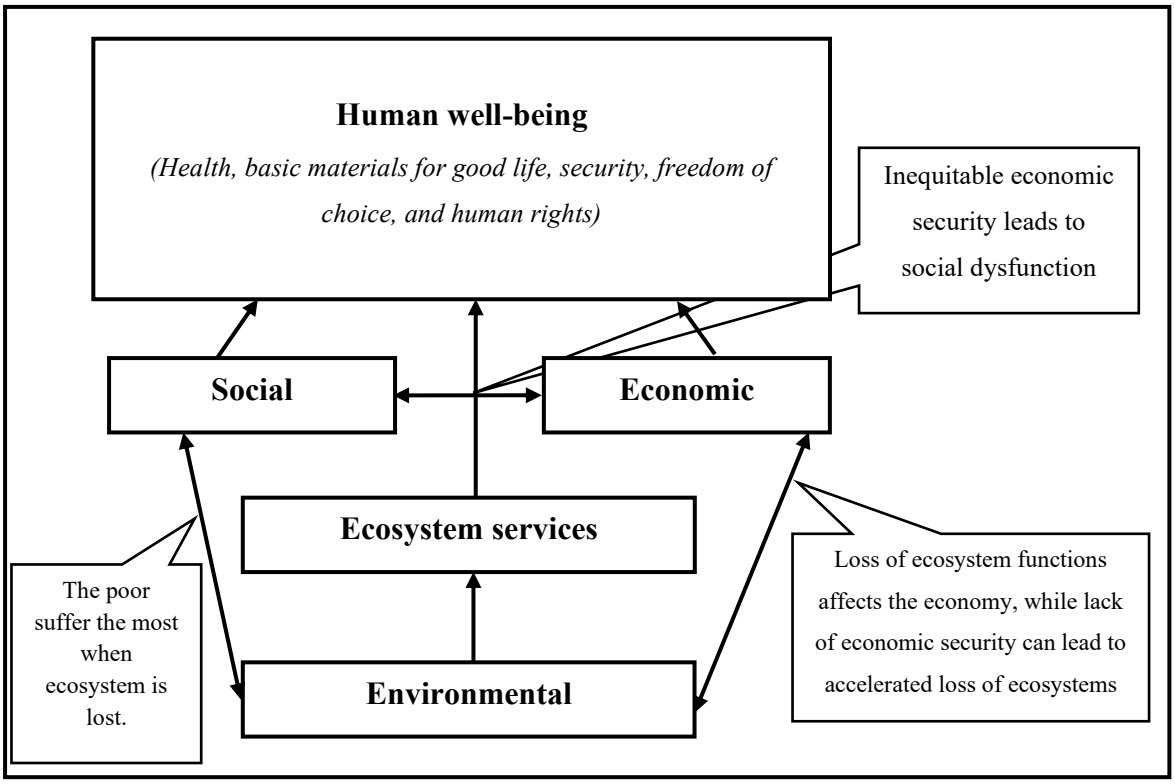

Figure 1. The links between these three pillars of sustainable developments adopted from United Nations Environment Programme (UNEP, 2011)

2.1.2 Circular economy

The concept of circular economy has got momentum by both scholars and practitioners as it is often viewed as an operationalization for businesses to achieve much-discussed sustainable developments (Ghisellini et al., 2016; Murray et al., 2017). Likewise, sustainability, the circular economy also means many different things to different people.

So, it is important to know the current understanding of the circular economy in a transparent way.

(Kirchherr et al., 2017) analyzed 114 circular economy definitions in 17 dimensions and formed a coding framework for them. Their study shows that these definitions mostly depict a combination of the terms of reduce, reuse, and recycle activities. Sustainable development issues were not properly linked in these definitions and though economic and environmental quality issues were mentioned, social equity and future generation were hardly discussed.

(Geissdoerfer et al., 2017) discussed the origin and development of circular economy definitions and found that different definitions have different contributions. Thus, they combined these contributions and proposed a comprehensive definition of circular economy as *"a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops. This can be achieved through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling".*

The current popular concept of circular economy is formulated from the basis of the concept of scientific research on sustainable development (Korhonen et al., 2017). Hence, it is pertinent to look back again at the major challenges of sustainable development. Physical flows of materials and energy are the main challenge of the circular economy. Linear consumption (one way) of materials and energy between humans and nature is the key issue in global sustainable development. Brown (2006) shows that the global natural ecosystem is getting smaller in size and volume for linear consumption. Figure 2 shows the shrinking of the parent ecosystem.

Linear throughput flow is creating undesirable development of the global economy. Our current human economy is a physically growing subsystem within the parent earth's ecosystem. In the subsystem, we extract resources and energy from the parent system but dump the wastes generated in the nature in harmful ways (Brown, 2006). Thus, the parent ecosystem that used to be a constant is now shrinking in physical scale. The eventual result is that the life-supporting earth is now reducing its harmonious condition. Visible results

are like expanding deserts, the rising water level in the sea. Many researchers found that this linear flow of consumption of materials and energy is undesirable having an enormous negative impact on the three-dimensional aspects of sustainable developments (Brown, 2006).

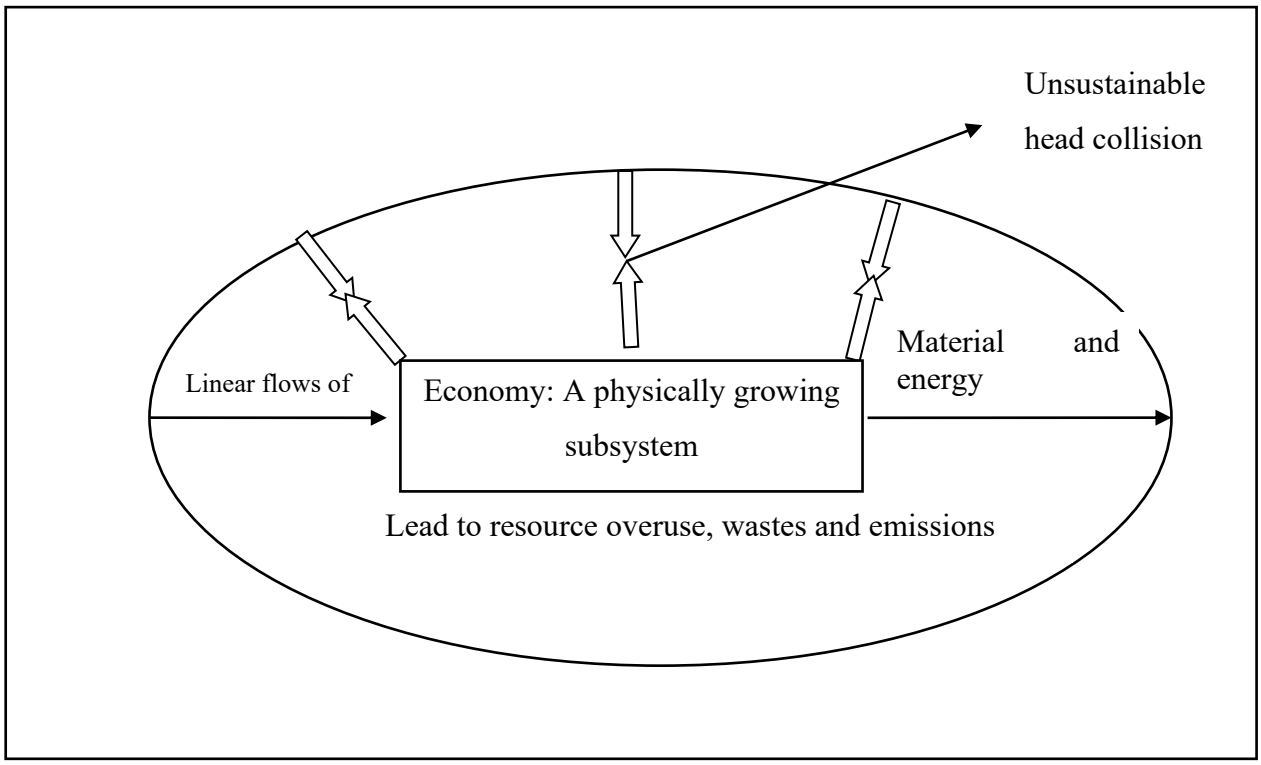

Figure 2. Shrinking of the parent ecosystem adopted from Brown (2006).

A simple and logical solution to this problem is avoiding linear flows of resources and doing reverse that is cyclical flow, circular economy concept. Taking sustainable development challenges into account the researchers and the business world formulated the circular economy concept illustrated in Figure 3. The inner circles demand less energy and resources and are more economic. The time in resources lives in the inner circles should be maximized. The message from this concept is that reuse, refurbishment, and repair should be the first option then for remanufacturing materials and energy followed by recycling (see Figure 3). Landfill for disposal should be the last option in the circular economy

concept. In this way products life cycle, quality, and value chain can be retained to their maximum possible level (Brown, 2006).

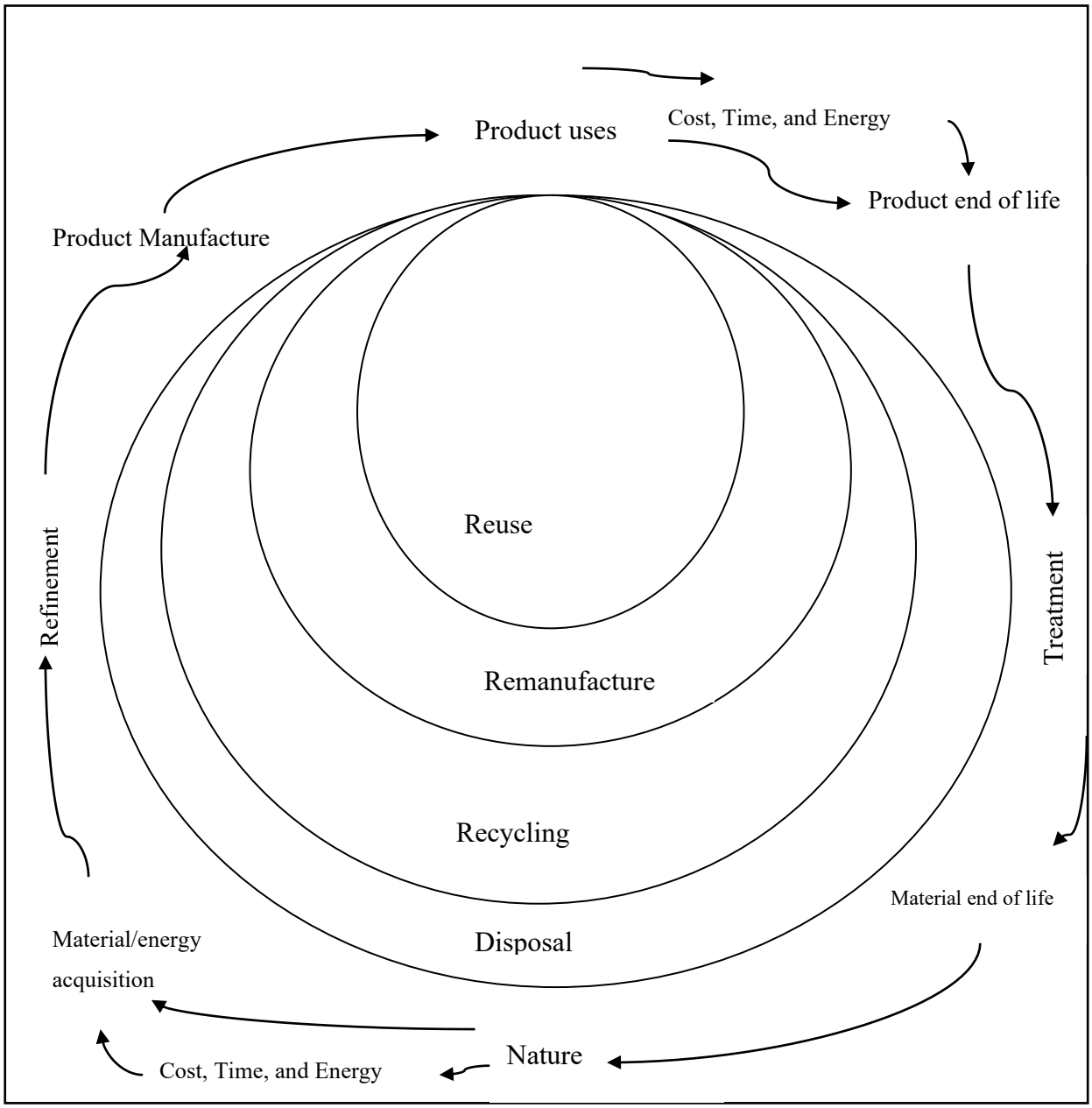

Figure 3. Current concept of circular economy where inner circle demands less energy and resources and are more economic adopted from Brown (2006).

(Korhonen et al., 2017) critically considered the concept of circular economy and on the basis of sustainable development and its three dimensions suggested the following definition of the circular economy.

"Circular economy is an economy constructed from societal production-consumption systems that maximizes the service produced from the linear nature-society-nature material and energy throughput flow. This is done by using cyclical materials flows, renewable energy sources and cascading-type energy flows. Successful circular economy contributes to all the three dimensions of sustainable development. Circular economy limits the throughput flow to a level that nature tolerates and utilises ecosystem cycles"

The win-win potential of the circular economy contributes to all three dimensions of sustainable development; economic, environmental, and social. Some win-win aspects are illustrated in Figure 4.

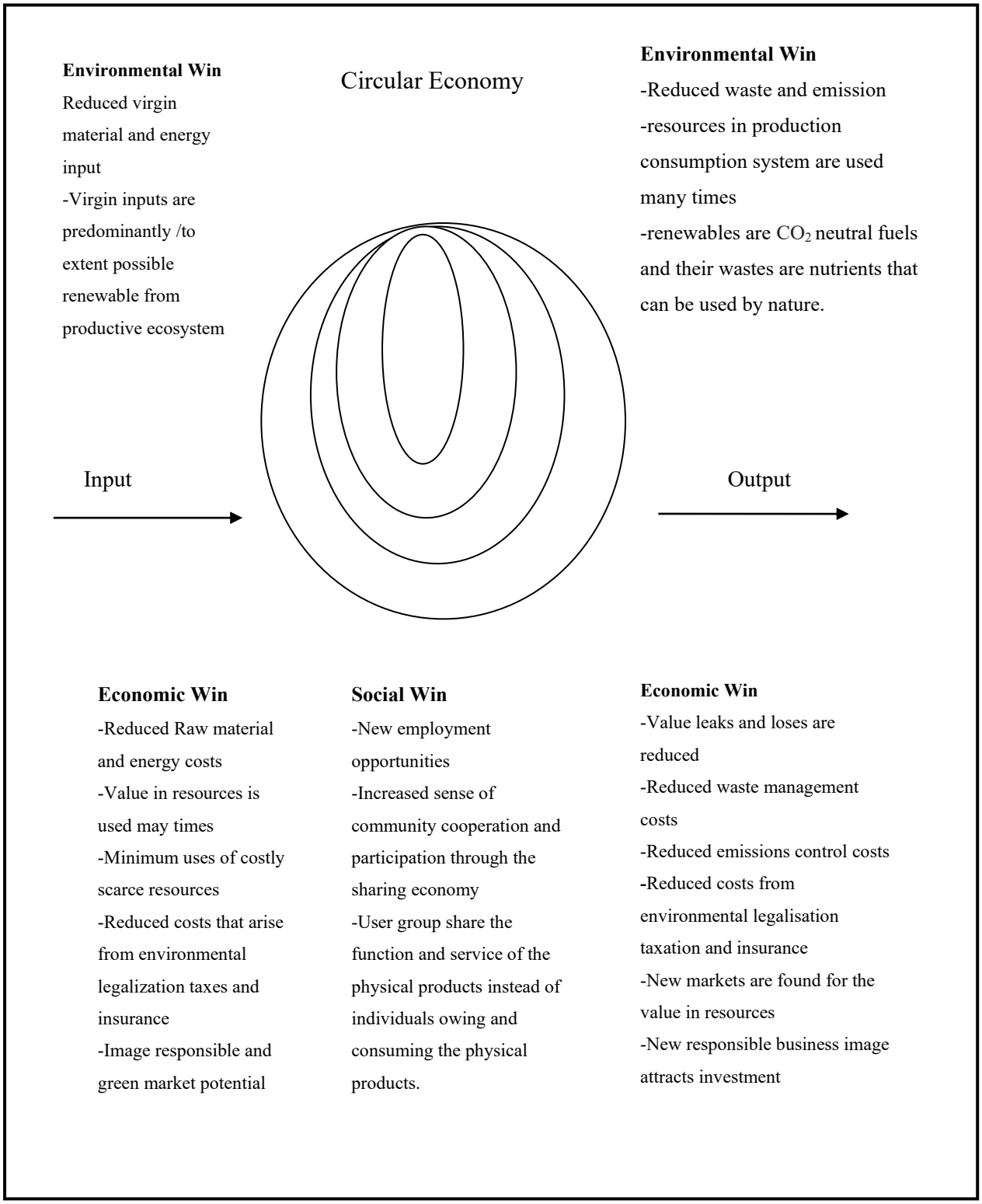

Figure 4. The win-win potential of circular economy adopted from Korhonen et al. (2017)

Resources of present days can be divided broadly into two categories: natural and manmade. The circular flow of both resources is significant to achieve greater success in sustainable development. Ellen MacArthur Foundation (2012) tried to capture the essence of circular economy in a diagram that is separated into two distinct halves which describe two distinct flows of materials one biological and one technical (see Figure 5).

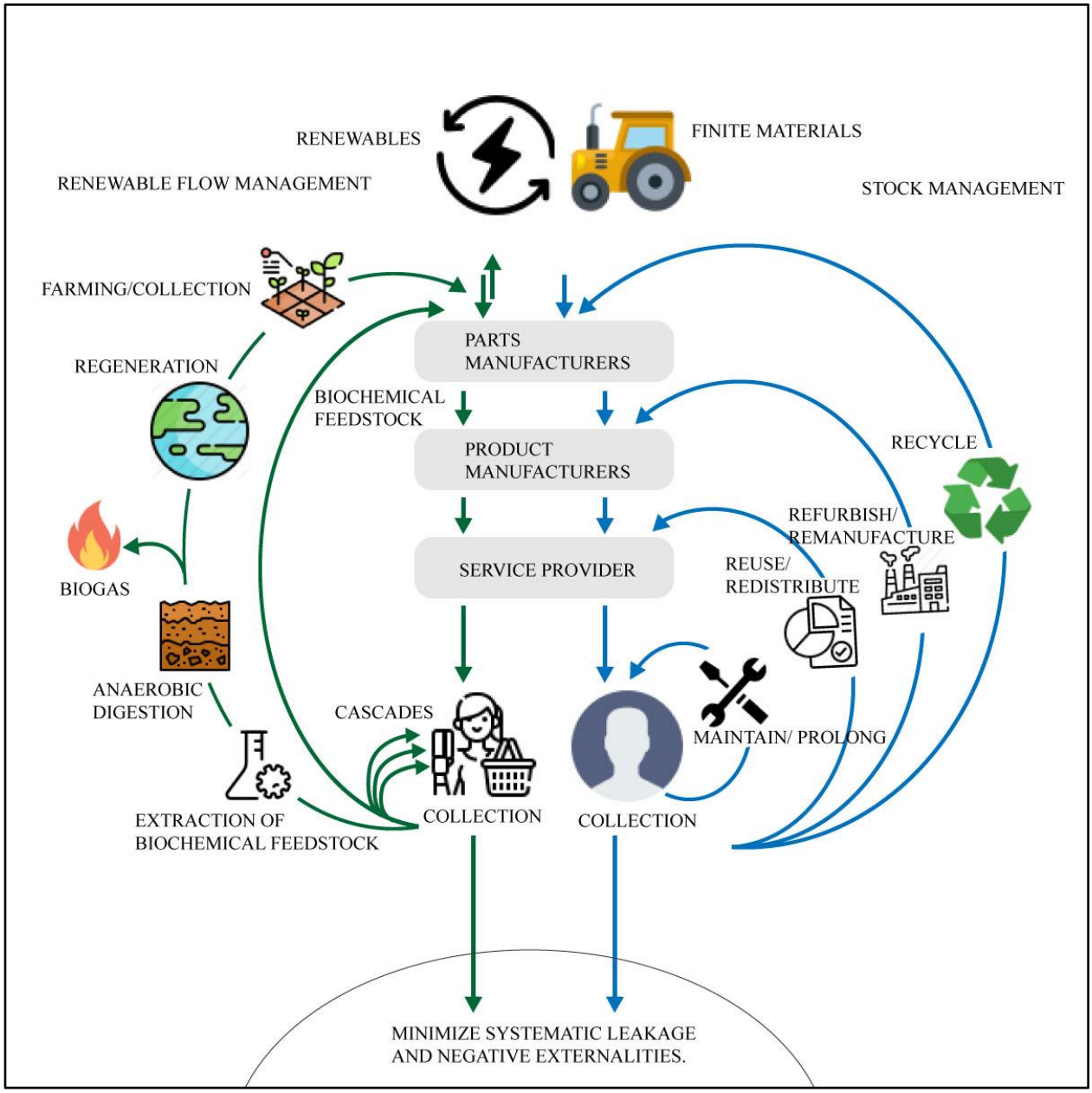

Figure 5. Circular flow of biological and technical materials adopted from EMAF (2012)

The left side of the diagram is green which represents the circular flow of biological materials. Characteristics of these materials are that they can safely re-enter the natural world after several use cycles. They eventually get bio-degraded, and the nutrients return to the environment (EMAF, 2012). Cascade is the most expected loop in the biological cycle of the diagram where used materials and components are put into different uses. Materials might get different applications before returning the nutrients to the soil (EMAF, 2012).

On the other hand, technical materials are represented on the right side of the diagram. Materials of these kinds do not easily enter the Earth. Metals, plastics, synthetic chemicals are some of the examples. They need to be recycled continuously by a specially designed system so that their values can be captured or recaptured before disposal. Maintain/prolong life span, reuse/redistribute, refurbish/remanufacture, and recycle are the major loops of the circular flow of technical materials (EMAF, 2012). Maintain or prolonging the lifespan of technical materials is the most expected loop of the cycle where the strategy is to use the materials as long as possible by ensuring the durability of the products. The second loop is the reuse or redistribute where the focus is on using the materials multiple times or redistributing the materials to new users. In refurbish/ remanufacturing loop the materials are restored to their value by disassembling into parts level and repairing to get extended life of the core products. Recycle is the final loop of the cycle where products are taken back to their basic material stages so that they can be used to make remake the product or making entirely new products (EMAF, 2012).

2.2 Human Factors

One of the research questions of this thesis is to know how human-related issues were addressed in the changing business trend to the circular economy. The current business world is seeking sustainable development and sees its future in the circular economy. Even though human health is in the core of sustainability, CE has not managed to include human health into its' core elements. Thus, it is important to pay attention more how humans are discussed in this context now in order to initiate discussion about it for the future.

People are considered the key factor for socio-economic development (Terziev et al., 2019). They are considered a critical asset for an organization. The success of an organization largely depends on the ability of its human resources (Mohammed et al.,

2013). Any change or revolution can only be achieved through an effective changeover and proper implementation of all the associated factors from all the stakeholders. People or humans are the most important stakeholders for an organization. The development of human resources management (HRM), without any doubt, is essential to make it possible to successfully moving into the world of the circular economy. Human resource development (HRD) is the most important among the functions of HRM. The reasons why HRM is given extra importance are that human resources are not like other resources of an organization. All other resources can be adopted or discarded at any time depending on their necessity. But, human resource needs special treatment. Humans need to be carefully recruited, demand extra efforts to retain, and eventually need to be trained and improved to upgrade capability along with the strategic development of the organization (Mohammed et al., 2013). Johnason (2009) defined human resource management as the strategic approach of a company or organization to effectively manage its people or employees so that they can bring business success through competitive advantage. Maximization of employees' performance for the strategic objective is the key factor considered in human resource management.

Before this thesis relates the issues of human resource management with the circular economy, a study through the concepts of human resources management along with its area of discussion and functions is highly encouraged. In this regard, this section of the thesis is going to discuss the concepts of human resources, their functions, human factors (HF)/ergonomics, occupational safety and health, and the competence development of human resources.

The business world moving towards the circular economy is a strategic step for sustainable development. Human resources being an important stakeholder demands strategic approaches to gain the strategic goals of sustainable developments through a circular economy. Academics show different components of strategic human resources management which mainly includes policies, cultures, values, and practices. Researcher Schuler (1992) proposed 5-P model (see Figure 6) for strategic human resource management which I consider relevant to this thesis to understand the components and activities of human resource management especially when integration and adoption of new business strategy is a concern. The model incorporates various HR activities with strategic

needs. The five P's refer to Philosophy, Policies, Programs, Practices, and Processes. The model effectively shows the interrelatedness of HR activities. Thus, the model provides a comprehensive understanding of complex interaction. The researchers also figured out some implications of the framework. Some of them are discussed here. Firstly, HR management starts with the successful identification of strategic business needs. When needs are important and properly identified HR activities are set in accordance to meet them. Secondly, since all the employees are involved, the participatory process gets smoother and proper links between the strategies and HR practices are established. Thirdly, it explores the opportunity for the formal study by the HR academics as the organizations go through the transition, a real-life laboratory learning.

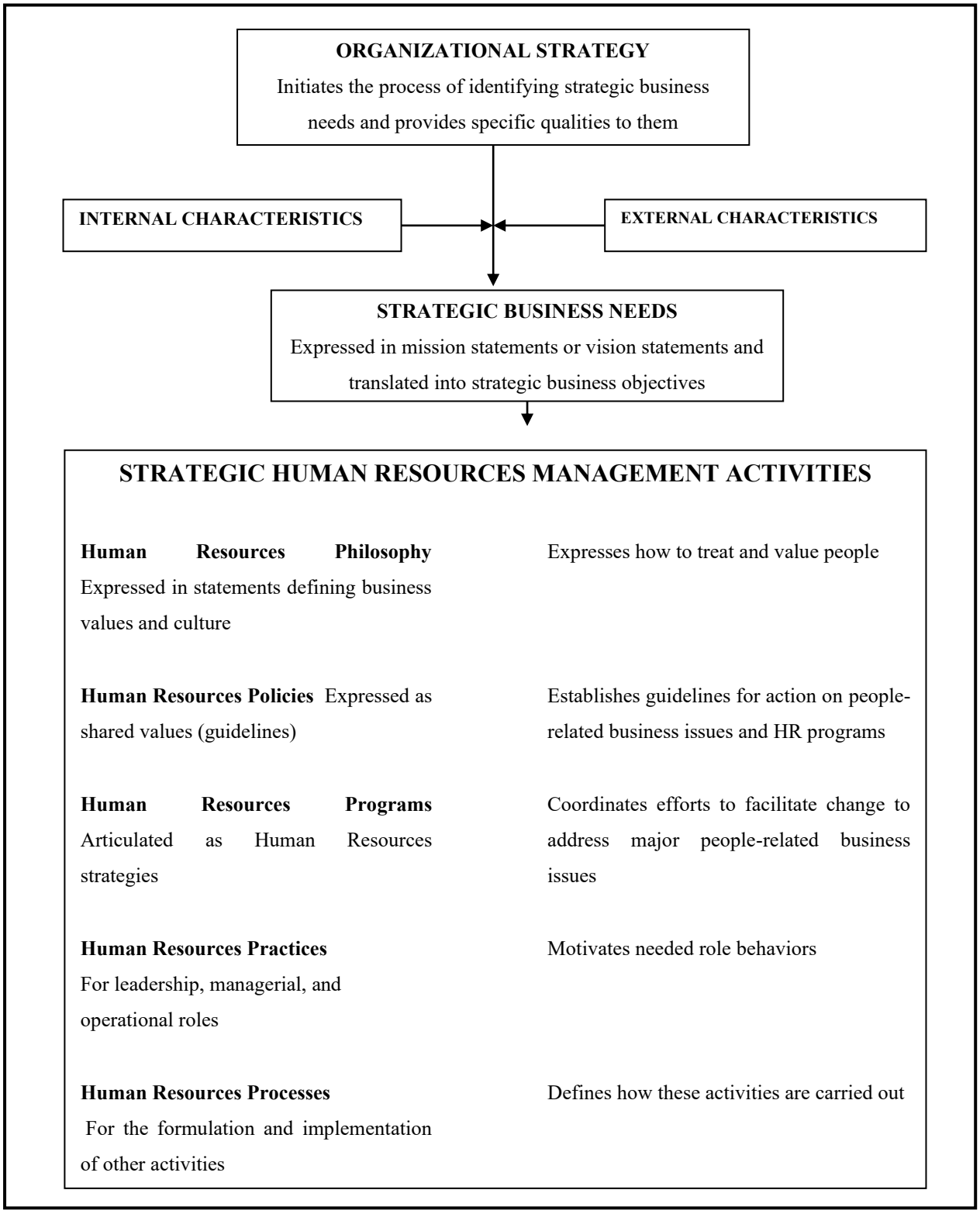

Figure 6. The 5-P model: linking strategic business needs & strategic HR management activities adopted from Schuler (1992)

2.2.1 Employee wellbeing and productivity

Employee health & wellbeing has a significant impact on sustainable development and eventually on circular economy where wellbeing is mentioned as a summative concept characterizing the quality of lives and considered as the major determinant of productivity at the individual, organizational and societal sphere (Schulte et al., 2010). Researchers argued that health should be seen as a core precondition for sustainable development (Kjærgård, et al., 2014). As resource efficiency is one of the prime aims of circular economy and human or employee wellbeing is determinant of productivity, it is obvious that human should also considered from circular economy perspective. As the human factors or ergonomics will be discussed in the following texts, we will see that human factor is a discipline that relates both the human health and productivity in a system simultaneously. For better understanding of employee health and wellbeing it is important to know the concept of human factors or ergonomics (HF/E) at an elementary level.

Over the period, the nature of work and technology involved has changed drastically which demands to rethink about humans working in parallel with them. Different organizations and researchers have defined ergonomics differently from different points of view. According to the International Ergonomics Association (IEA, 2000)- the word ergonomics has come from the 'Greek word *ergon* meaning work and *nomos* meaning laws. According to them ergonomics or human factors is the scientific discipline that explores the understanding of the interactions between humans and other elements in a system. The discipline studies especially with theory, principles data, and different methods to design the system that helps to maximize human well-being and eventually the performance of the system ie productivity. Ergonomics contributes to designing the system, evaluating tasks, jobs, products, and environment so that they can be compatible with human abilities and limitations. It considers physical, cognitive, organizational, sociotechnical and other factors (see Figure 7). The focus of HF is fitting the environment to the human. The environment is complex and can refer to the physical environment, organizational environment, and social environment (IEA, 2000).

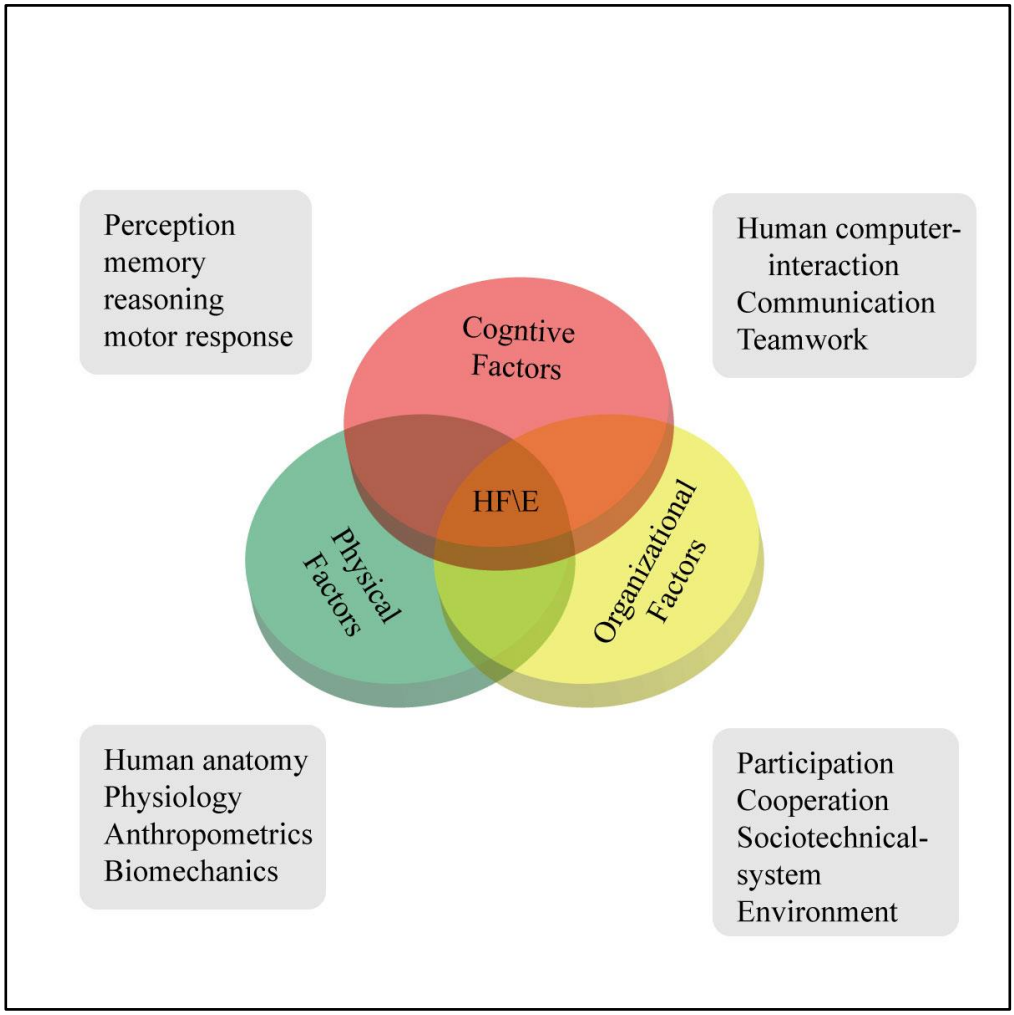

Figure 7. Areas of Egonomics adopted from IEA (2000).

Three fundamental attributes are found from these discussions; HF takes a system approach, it is design-driven, and focuses on performance and well-being. HF taking systematic approaches focus on strategic goals and design systems including humans and the environment (Helander, 1997). The environment here can be a workplace, product, tools, software, technical services organizational designs, etc (Wilson, 2000). When problems are defined and solutions are formulated, specific aspects of people, specific aspects of the environment are focused to define system boundaries. This broad perspective is referred to as a system approach.

Karwowski (2007) argued that ergonomics is a discipline that has a primary focus on human and nature interventions united from the perspective of science, management,

engineering, technology, and design. Various dimension of human factor discipline is illustrated in Figure 8.

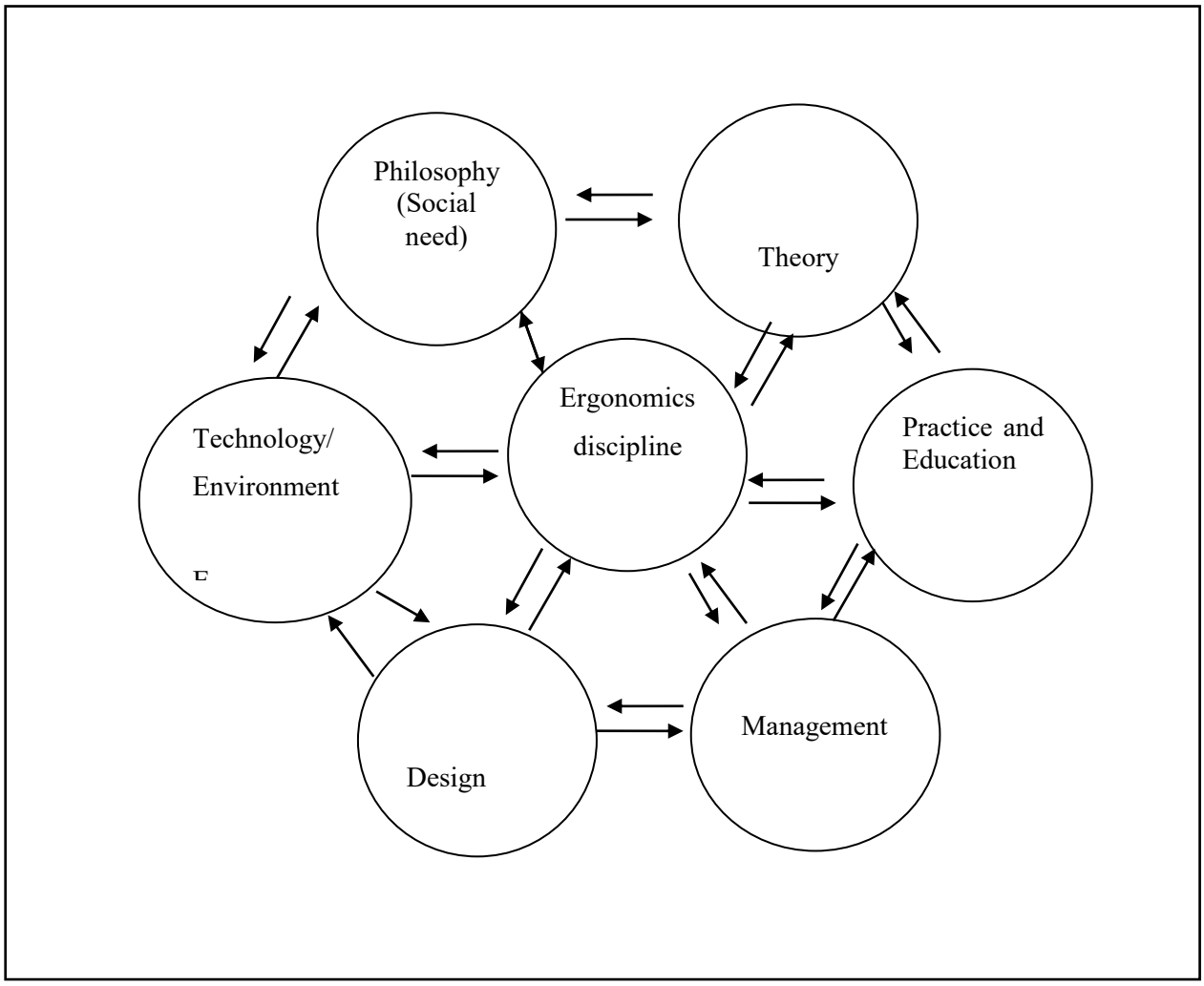

Figure 8. General dimensions of ergonomics discipline adopted from Karwowski (2007)

Human factors consistently seek new designs or improve designs for better performance and well-being through consistent analysis and assessment which eventually provides some sets of recommendations and actions. This is carried out in all the stages of planning, implementation, maintenance, evaluation, design, redesign, and continuous improvement of the system (Japan Ergonomics Society, 2006).

HF has some definite focuses on performance and well-being (see Figure 9). HF improves performance through improving productivity, effectiveness, quality, efficiency, safety,

sustainability. Where well-being is achieved by considering health issues, pleasure, satisfaction, personal development, and learning. (Wilson et al., 2009). Thus, performance influences well-being and well-being can also influence performance.

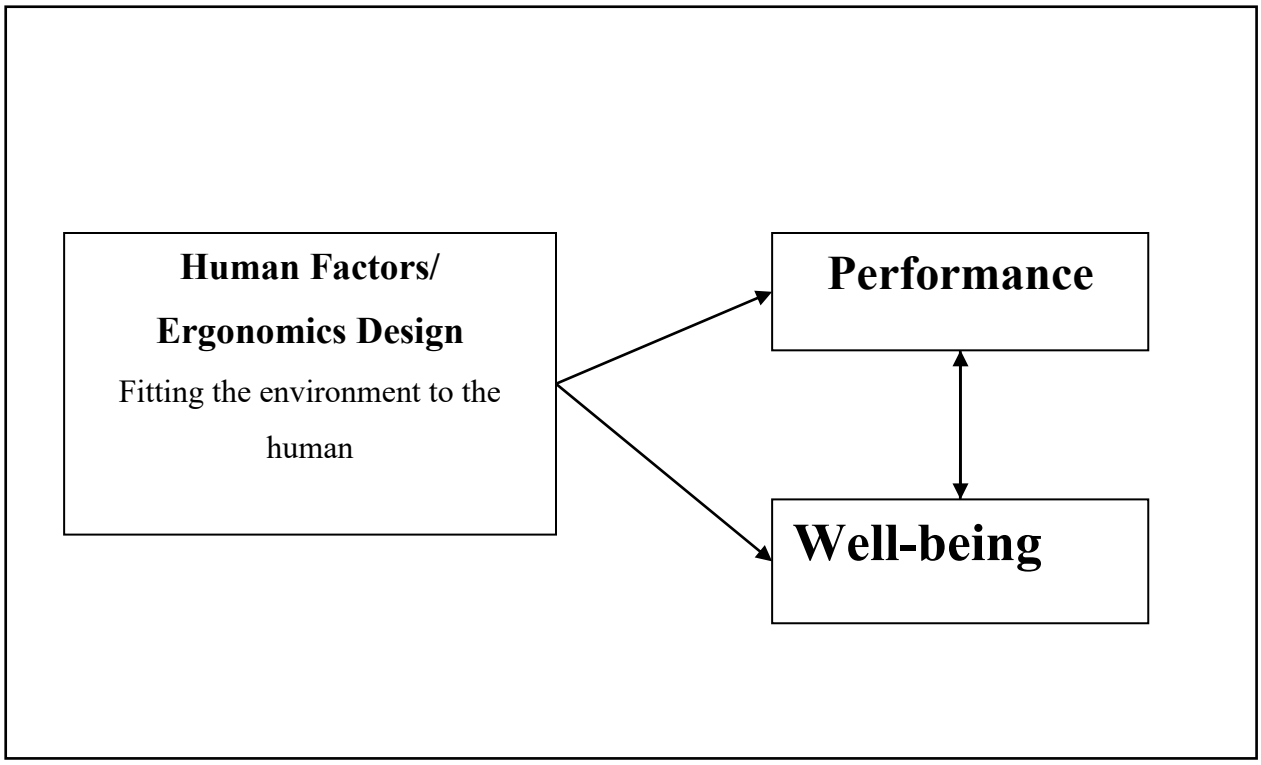

Figure 9. Effect of performance and well-being on human factors design adopted from Dul et al. (2012)

According to Docherty (2002), obvious synergies should always be there between goals of work and goals of ergonomics where the focus is on the fitness at work and work-worker alignment.

Sustainable development and human factors are strongly interconnected and they must focus on human elements (Steimle et al., 2006). Zink (2008) with the help of Dyllick and Hockerts' (2002) TBL model for sustainable development illustrate to explain how human factors exert impact on sustainable development.

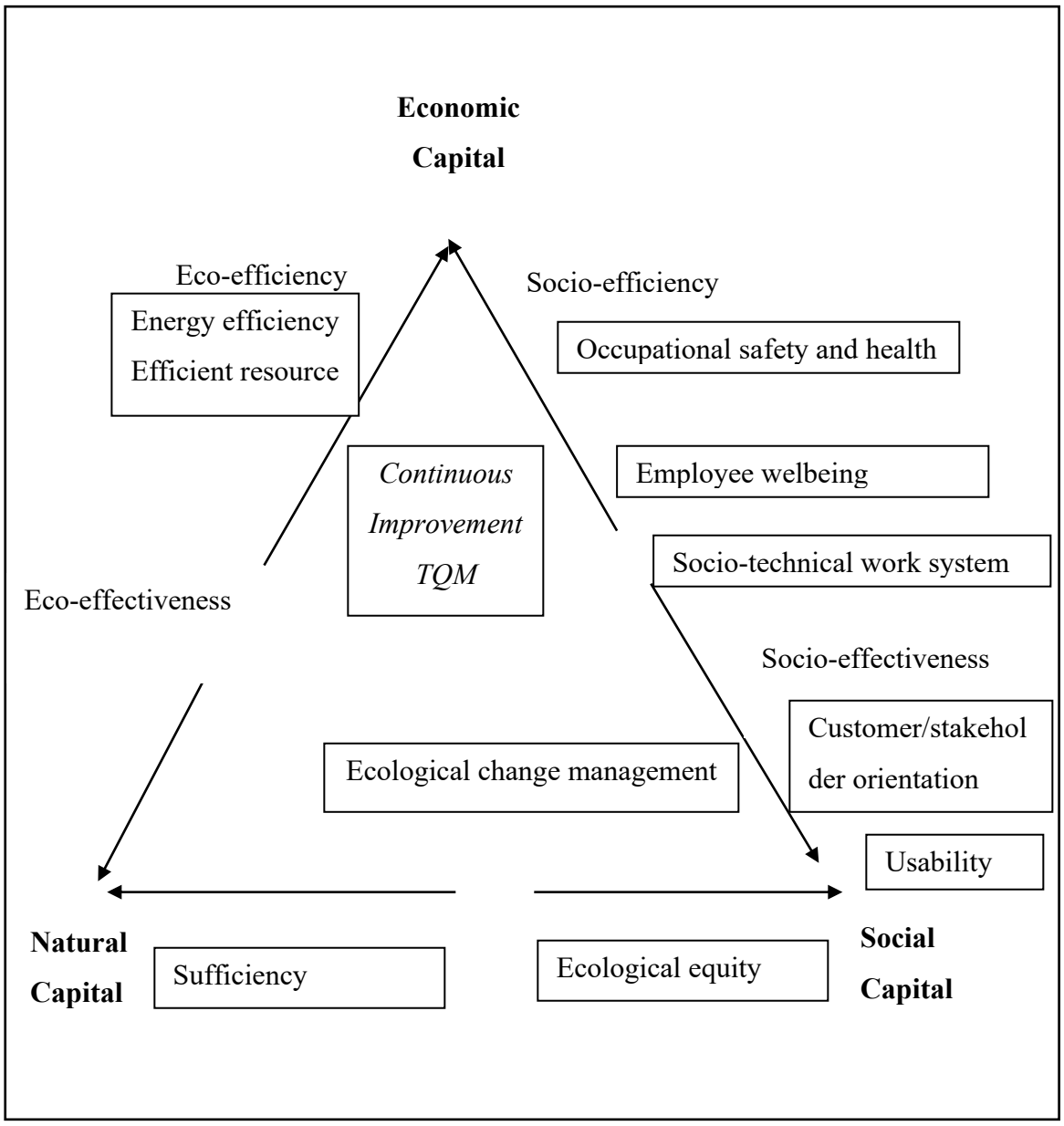

Figure 10: Corporate sustainability and ergonomics interventions adopted from Zink et al. (2008)

Green ergonomics is another terminology that especially has a pro-nature focus; it targets human affinity with nature. Green ergonomics considers the whole planet as a closed system where any disruption by any elements affects the other parts of the system. Figure 11 illustrates that nature and human has a bi-directional relationship; human affects the health of the natural environment and in turns, the health of natural environment affects the wellbeing of humans (Thatcher, 2013).

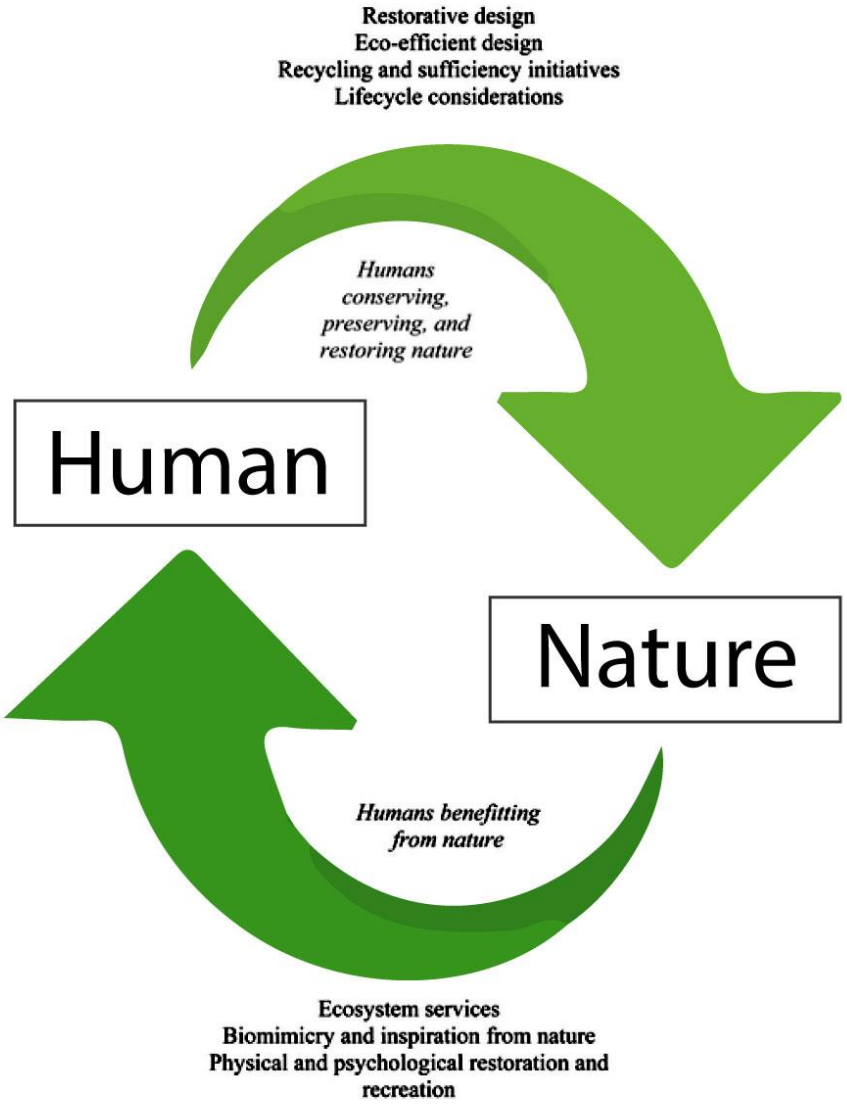

Figure 11. Bi-directional relationship between humans and nature adopted from Thatcher (2013).

2.2.2 Occupational safety and health

As discussed in the previous sections it is now obvious that employee wellbeing and health is significant in circular economy context. Hence, it is also important to discuss the issue from the occupational safety and health perspective. 63% of the world population belongs to various types of workplaces in the world which estimates a total of 3.5 billion people. These people spend one-third of their adult life in the workplace providing materials for society, nations, communities, and individuals (Statista, 2019). Though the world has

witnessed revolutionary development in technologies for digitalization, artificial intelligence (AI), and robotizations, human work is still the key factor for the material basis for societies and countries.

Positive impacts of globalization on the global economy are prominent; similar positive impact is also visible in the distribution of technologies and enhancement of global connectivity. However, social impact especially health issues associated with the workplace is not universally positive (Rantanen, et al., 2020). Over the last few decades, the nature of works and technologies involved have changed a lot which has introduced us to new hazards in the workplace (Goetsch, 2010). ILO predicts to witness a major transformation of how we work driven mainly by the changes in technology, environment, and demography.

ILO (2015) estimates that everyday occupational accidents or diseases cause 6,400 people to die, meaning 2.3 million death every year. In addition, 860,000 people get injured while working. ILO also estimates that the cost of business is US$2.8 trillion annually which is 4 percent of global GDP through loss in valuable working time, disruption in the production process, medical cost for workplace injuries and diseases, and rehabilitation and compensation. Ergonomics issues in workplaces and workplaces with the bad working condition is one of the major contributing factors to increase risk factors to the above discussed occupational safety and health problems (Niu, 2010). These occupational accidents and health-related issues are huge burdens for both the organization and state which negatively affect international competitiveness. Annual costs from accidents in workplaces and diseases impact high compensation, less productivity, more medical insurances.

Elimination of poverty is one of the important sustainable development goals. Rantanen (2020) argued that the only sustainable way of eliminating poverty is by employing the work-age population. Good and decent workability (including health, competence, skill, and motivation), workplace safety, and health at work are the prerequisites for employability. Globally, work-related loss of disability-adjusted life year (DALY) is found on the basis of work-related diseases (WRD) and 11% is the occupational injuries. The development of decent work has major challenges in the management and prevention of

work-related diseases (WRD). A few of WRDs are musculoskeletal disorders (MSDs) (15%), cardiovascular disorders (CVDs) (17.2%), and occupational cancer (12.4%). The rest 50% comes from other work-related diseases (Takala, J., 2019). Increased magnitude of musculoskeletal disorders (MSDs) is one of the work-related diseases which is the result of poor workplace environment caused by prolonged sitting or standing in postural stress, repetitive task that leads to chronic injury, environmental factors, psychosocial factors which includes complex social issues, job dissatisfaction, etc. (Frymoyer, et al., 1986).

2.2.3 Employment issues

Sooner or later sustainable development will be a corporate strategy that relates to the company's strategic HRM. Employment management is one of the key responsibilities of an enterprise. The hire and fire attitude of employers is not going to help in the long run. Careful recruitment by analysing the potentiality of candidates together with the development of skill, and appraisal sustain the employee-employer relationships (Ehnert, 2014, p.6).

According to the researcher Ehnert (2014), entreprises mainly try to address following objectives through strategic sustainable HRM.

- Attracting potential talents and retention of skilled employees
- Taking care of employee's health
- Investment for the development of long-run skill and competence
- Maintaining work-life and work-family balance
- Management of aged employees
- Creating a work environment which upholds employee-employer trustworthiness.
- Exhibiting CSR activities
- Management of high-quality life for workforce and communities (Ehnert, 2014, p.6).

2.2.4 Competence development

Competence or competency is considered the key resource for an organization to be utilized to gain competitive advantages (Campbell, 1997). Hamel and Prahalad (1994)

defined core competence as the collective ability of an organization by coordinating diverse skills with multiple dimensions of applied technology.

For the generic competence approach, a suitable typology of competence is significant for integrating education and training, matching both the market and individuals (Boon, 2002). Hodkinson (1995) proposed a holistic approach for competence that integrates knowledge, skills, values, and understanding. Similarly, Cheetham and Chivers (1996) developed a model having five inter-connected competencies. The framework has five dimensions.

1. Cognitive competence; underpinned theory and concepts with informal knowledge from experience.
2. Functional competencies; skilled in a particular job working in.
3. Personal competency; referred to behavioral competency.
4. Ethical competencies: possession of sound personal and professional values to make a sound judgment.
5. Meta-competencies: ability to deal with uncertainty.

Le Deist (2005) proposed a holistic typology that has four dimensions. Relationships between these dimensions of competence are illustrated in Figure 12. The relationship between innovation and learning must go together if continuous development of an enterprise is expected. Continuous competence development acts as a reflective fuel in organizational and individual improvement and achievement. Competence development is influenced by both the internal and external work relation and experience. In order to complete the learning process, it needs competence development, a combination of experience-based learning and reflective learning from various formal workshops, training, and education. Competence development and vocational training are considered two sides of the same coin in HRM.

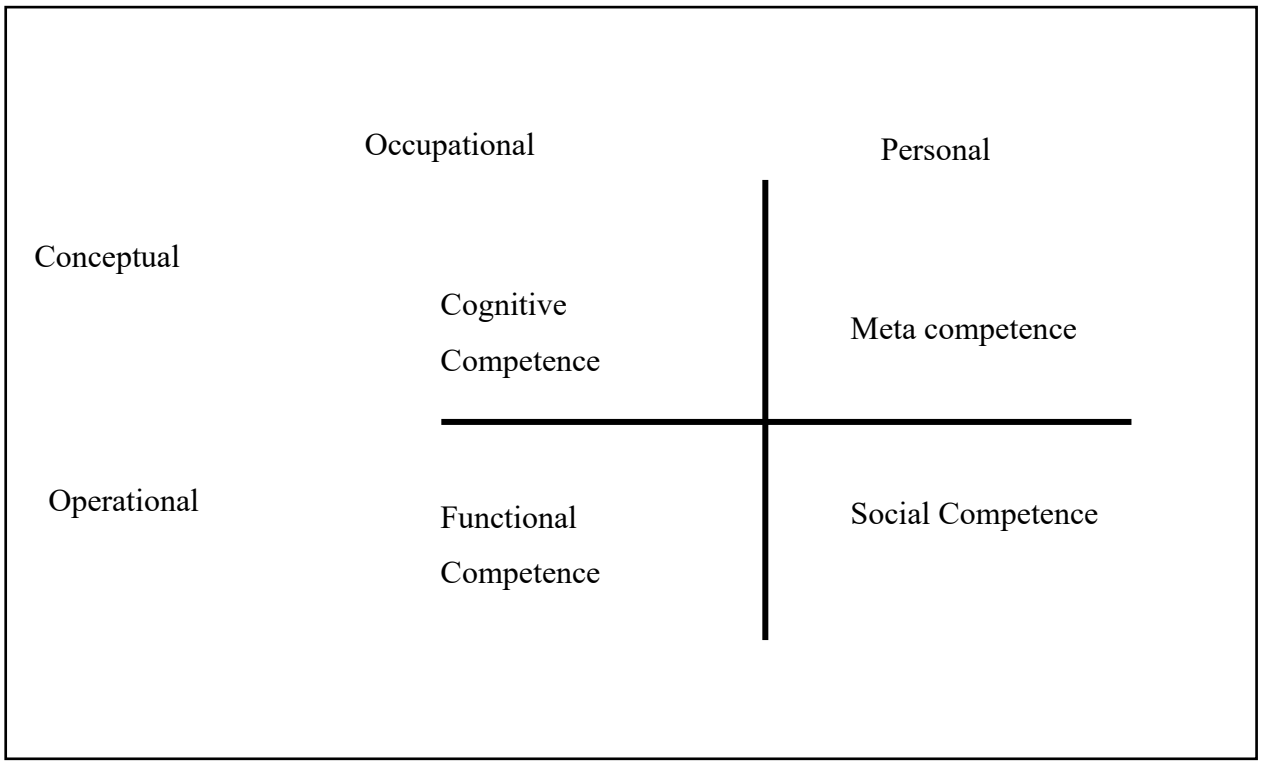

Figure 12. Typology of competence adopted from Le Deist (2005)

3 Methodology

3.1 Systematic Literature Review

Literature review has now become an essential part of academic research. Civilization has witnessed information and knowledge doubling at a robust pace. This ongoing knowledge advancement is a result of prior existing work (Xiao, et al., 2019). Researcher Fuller (2002) proposed ”Knowledge Doubling Curve” (see Figure 13). He looked at the history of the growth of information over the centuries. The picture illustrates that information doubled every century until 1900; after World War II every 25 years and currently on an average 13 months (Fuller, 2002).

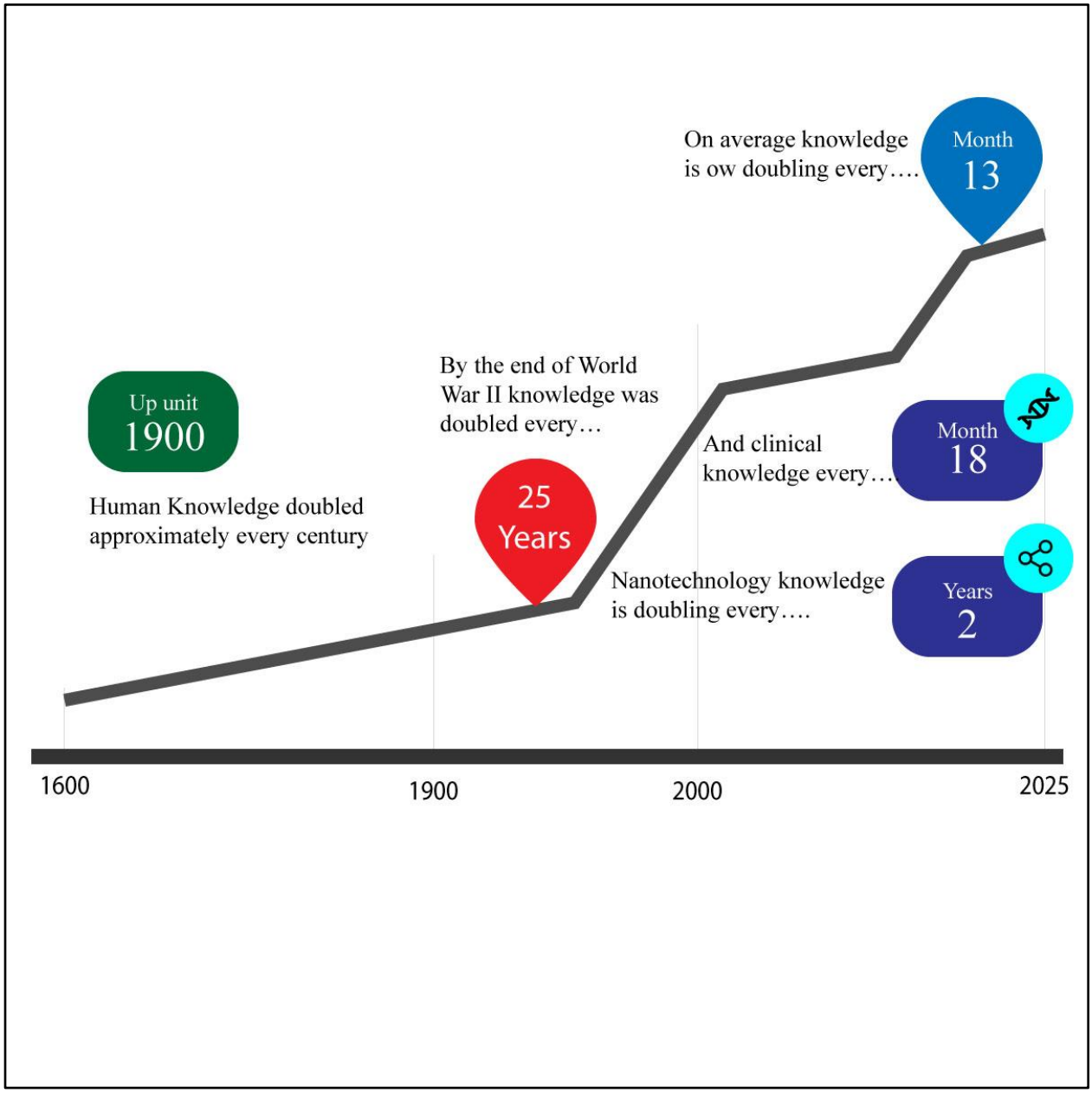

Figure 13. Knowledge doubling curve adopted from Fuller (2002)

Systematic literature review of relevant work and study provides a breadth and depth understanding of a field of knowledge and helps to explore the gaps (Paré et al., 2015). Studying, analyzing, and summarizing relevant literatures helps researchers to test a specific hypothesis or develop new theories. The systematic literature review also helps to evaluate the existing work to know the weakness, inconsistencies, and contradictions (Paré et al., 2015).

Systematic literature review responds to some certain set questions and it has a methodology that locates existing research studies to evaluate contributions, synthesize and analyze data to provide reports of evidence in a way that help to reach a clear conclusion to distinguish between known and unknown (Denyer et al., 2009).

The systematic literature review identifies, appraises, and synthesizes literatures including a list of articles published in the different peer-reviewed journals using well-defined and rigorous criteria (Thomé et al., 2016). The systematic literature review focuses on answering particular research questions, test theories, and hypotheses or introduce novelty theories limiting bias or systematic errors. In that sense, it is more a scientific tool than the discussion of literatures (Petticrew et al., 2006).

Researcher Mulrow (1994) identifies primarily nine uses of systematic literature review.

1. It helps to reduce large amounts of information.
2. It helps in the policy and decision-making process by integrating critical pieces of information.
3. It is less costly than conducting new researchers and updates continuously thus a very efficient technique.
4. It easily generalizes findings by taking and regrouping similar results from various populations.
5. Relationships among different variables are allowed in a systematic assessment.
6. Data inconsistency and contradiction are explained with evidence.
7. Statistical power is increased by quantitative synthesis.
8. Statistical risks are estimated with higher precision.
9. It is being systematic can be verified so higher accuracy of results. (Mulrow, 1994)

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) is reporting tool in the systematic review used in this thesis (PRISMA, 2020). Though PRISMA mainly focuses on review reports based on evaluating the relevant interventions, it is also used as a way to report systematic reviews with some set objectives besides the evaluation of interventions. Authors and journal peer reviewers and editors are the ones

who use PRISMA most as it helps authors in improving reporting of systematic reviews and reviewers and editors for critical appraisal of systematic reviews published in different peer journals (PRISMA, 2020).

For writing this thesis PRISMA 2020 checklist was followed accordingly. The section and topic covered in the checklist are as follows:

- Title
- Abstract
- Introduction
- Methods
- Results
- Discussion (PRISMA, 2020)

3.2 Data collection and analysis

The study is based on a systematic literature review. Figure 15 illustrates the phases of the review. To find the aim of the research i.e. answer to the research question, a number of the search keywords were first decided with the proper guidance of academic supervisors. The research topic has two parts: the human side or HRM and the circular economy (see Figure 14). The human side of the review was covered by the keywords: human factors, ergonomics, human resources, human engineering, human errors, employee health, employee wellbeing, and occupational safety; and, the circular economy part was covered by the keyword circular economy itself. The author first tried to make searches also using circular economy, sustainability, and sustainable development under circular economy but as the results grew significantly (around 43 thousand) the decision was made to focus solely on CE.

The search operator ‘OR’ was used for all the keywords of the human side and these results were linked together with the circular economy by using the search operator ÁND’. The search was carried out into the articles’ topics, keywords, and abstracts in the cross-disciplinary international research literature database Scopus and took place on May 2, 2021. No exclusion criteria were included in the search though languages other than

English were not considered. So the searches were not limited to empirical studies, and studies from different industrial sectors were included.

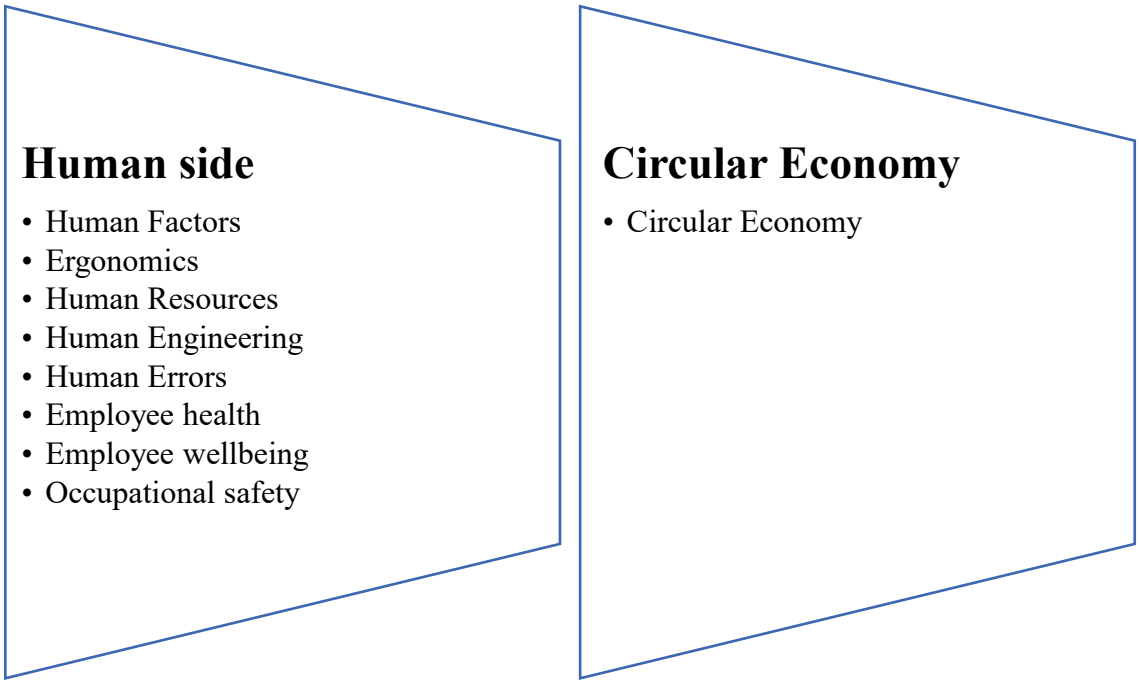

Figure 14. Keywords used to find the relevant articles

The search string looked like the following:

(TITLE-ABS-KEY (*human* AND *factors*) OR TITLE-ABS-KEY (*ergonomics*) OR TITLE-ABS-KEY (*human* AND *resources*) OR TITLE-ABS-KEY (*human* AND *engineering*) OR TITLE-ABS-KEY (*human* AND *errors*) OR TITLE-ABS-KEY (*employee* AND *health*) OR TITLE-ABS-KEY (*employee* AND *wellbeing*) OR TITLE-ABS-KEY (*occupational* AND *safety*) AND TITLE-ABS-KEY (*circular* AND *economy*))

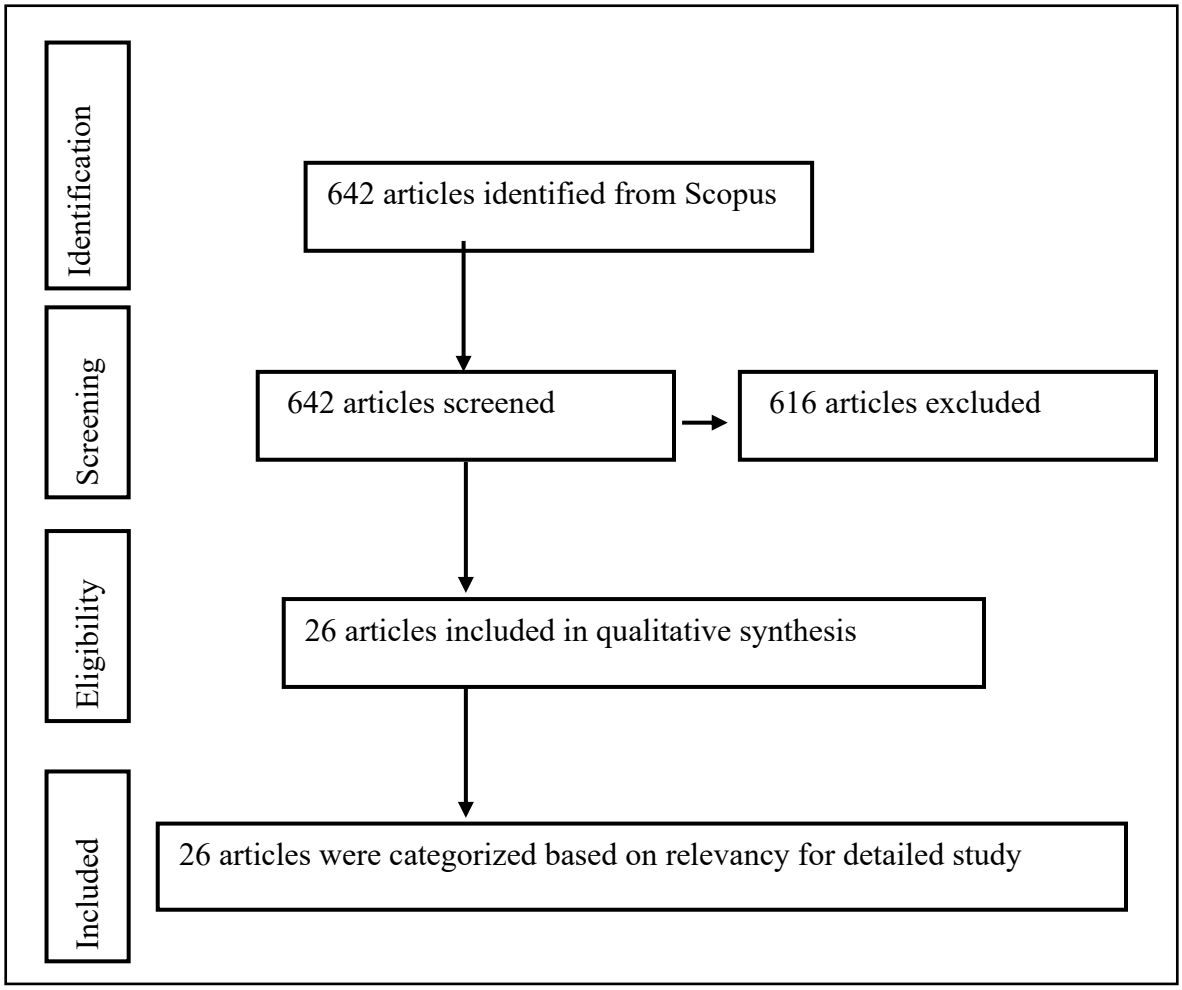

Figure 15. Phases of the systematic review

A total of 642 articles were returned in the search. All these articles were screened in titles, abstracts, and keywords. In this screening phase, the focus was on determining whether the articles considered the human side and circular economy to some extent. 616 articles were found not addressing the human side or discussing only the circular economy or not linking these two sides of the research aim and thus excluded. Through assessing and determining the eligibility 26 articles were finalized for systematic review (see table 1). These articles were also categorized based on their merits of relevancy to the review aims.

Table 1. Final 26 articles with journal information and a short description

SL	Author(s)	Article Title	Journal/Conference	Short description of the article
1	Maerckx, et al., (2019)	Building circular in Brussels: An overview through 14 inspiring projects	IOP Conference Series: Earth and Environmental Science	Conference paper based on construction projects in Brussels.
2	Chiappetta Jabbour, et al., (2019)	Who is in charge? A review and a research agenda on the 'human side' of the circular economy	Journal of Cleaner Production	Review article to integrate CE business model and human side.
3	Sihvonen, et al., (2018)	A survey of perceived prevalence of selected environmental topics in product development, and their relationships with employee's	Journal of Cleaner Production	A survey to assess environmental topics and perceived ecodesign practices

		ecological concern		
4	Ahmad, et al., (2019)	Organizational and human factors related challenges to ISO 20000: Implications for environmental sustainability and circular economy	International Journal of Manpower	The article explores organizational and human factor-related challenges to information technology (IT)
5	García-Quevedo, et al., (2020)	Barriers to the circular economy in European small and medium-sized firms	Business Strategy and the Environment	Cross-sectional survey to identify barriers in promoting CE
6	Héry, et al., (2020)	Development of a circular economy and evolution of working conditions and occupational risks—a strategic foresight study	European Journal of Futures Research	Foresight study to assess the main consequences on occupational safety and health.
7	Klein, et al., (2020)	Circular economy practices and strategies in public sector organizations: An integrative review	Sustainability (Switzerland)	Review to explore knowledge on the implementation of CE practices in Public Sector Organizations (PSOs)
8	Bag, et al.,	Key resources for	Journal of Cleaner	Empirical study in

	(2021)	industry 4.0 adoption and its effect on sustainable production and circular economy: An empirical study	Production	adoption of Industry 4.0 and effects on sustainable production and circular economy capabilities
9	Min, et al., (2021)	Proposing circular economy ecosystem for Chinese smes: A systematic review	International Journal of Environmental Research and Public Health	Identifies major barriers for Chinese SMEs CE adoption
10	Staicu, (2021)	Characteristics of textile and clothing sector social entrepreneurs in the transition to the circular economy	Industria Textila	Characteristics of CE business models in the textile and clothing sector in Romania
11	Milani, et al., (2020)	ENI professional models and technical careers	International Petroleum Technology Conference 2020, IPTC 2020	Conference paper on ENI professional models and technical careers.
12	Saha, et al., (2020)	Implementing circular economy in the textile and clothing industry	Business Strategy and the Environment	Current state of CE implementation in textile and clothing industry

13	Gaberščik, et al., (2021)	Saving lives and saving the planet: The readiness of Ireland's healthcare manufacturing sector for the circular economy	Smart Innovation, Systems and Technologies	Current state of CE implementation in health care sector
14	Stephan, et al., (2020)	Analysing material and embodied environmental flows of an Australian university — Towards a more circular economy	Resources, Conservation and Recycling	Case study on material flow to know opportunities for the implementation of CE
15	Schröder, et al., (2019)	The circular economy and the Global South: Sustainable lifestyles and green industrial development	Routledge	Book on CE sustaainability aned dgreen industrial development.
16	Winans, et al., (2017)	The history and current applications of the circular economy concept	Renewable and Sustainable Energy Reviews	History of CE concept and current application.
17	Quina, et al., (2018)	Technologies for the management of MSW incineration ashes from gas cleaning: New perspectives on	Science of the Total Environment	Identifies technologies for material recovery to avoid landfill.

		recovery of secondary raw materials and circular economy		
18	Ormazabal, et al., (2018)	Circular Economy in Spanish SMEs: Challenges and opportunities	Journal of Cleaner Production	Identifies CE challenges and opportunities in Spanish SMEs
19	Jin, et al., (2019)	Science mapping approach to assisting the review of construction and demolition waste management research published between 2009 and 2018	Resources, Conservation and Recycling	Identifies influences in the C&D waste management research
20	Bonviu, (2014)	The European economy: From a linear to a circular economy	Romanian Journal of European Affairs	Analyzes human activities in history of CE
21	Manfren, et al., (2020)	Linking design and operation phase energy performance analysis through regression-based approaches	Frontiers in Energy Research	Analyzes linking design and operation phases performance in buildings.
22	Jing, (2018)	Analysis of enterprise economic	Journal of Advanced Oxidation	Evaluates environmental

		management strategy based on circular economy	Technologies	benefits from enterprise.
23	Satori, et al., (2020)	Sustainability of waste bank and contribution of waste management	IOP Conference Series: Materials Science and Engineering	Identifies existing condition of waste bank and designs waste bank development.
24	Kimita, et al., (2020)	A practical approach for managing uncertainty in remanufacturing: Identifying leverage points using design structure matrix	Proceedings of the ASME Design Engineering Technical Conference	Proposes design method process for production planning and control in remanufacturing.
25	Xiancheng, et al., (2007)	Prospering revolution of resource efficiency in northeast industrial area in China	Chinese Journal of Population Resources and Environment	Analyses resource problem in China and proposes strategy for CE
26	Fernandes, et al., (2018)	Circular and collaborative economies as a propulsion of environmental sustainability in the new fashion business models	Lecture Notes in Electrical Engineering	Identifies convergence and divergence between sustainable development of fashion industry and business

				model of CE

4 Results

4.1 Descriptive Analysis

4.1.1 Literature published in different journals

As we can see from Figure 16, Journal of Cleaner Production is the journal that published most articles concerning employee wellbeing in circular economy context. Out of 26 it published 4 articles and Resources, conservation and Recycling journal published 2 articles.

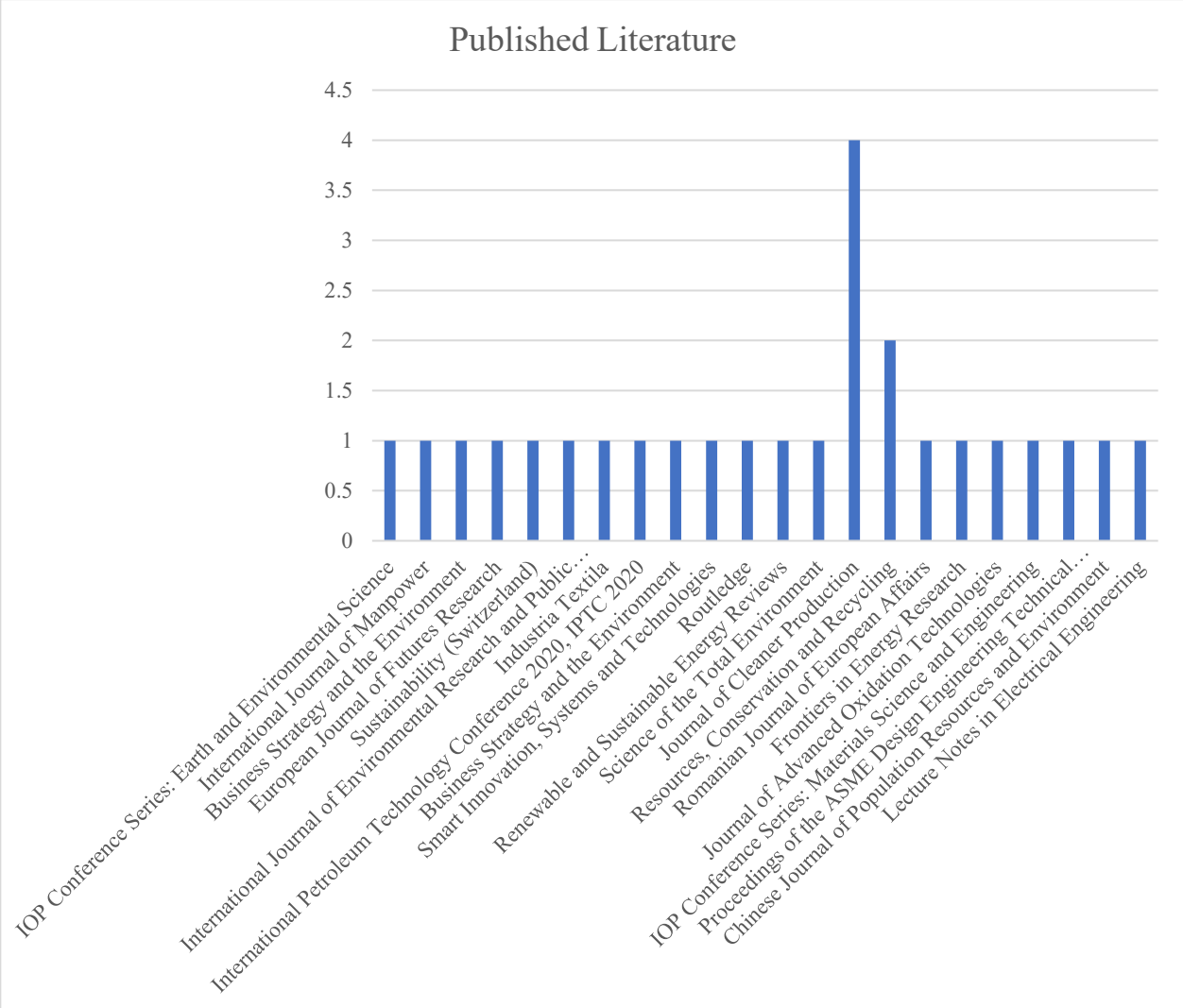

Figure 16. Journals/conferences/book publishers that published literature which relate human side with circular economy

4.1.2 Year of publication

As we can see from Figure 17, employee wellbeing in circular economy context is a new area of interest for researchers. The issue was not properly addressed previously. The screened 26 articles out of 616 were published in recent years. 2020 is the year when the most articles were published.

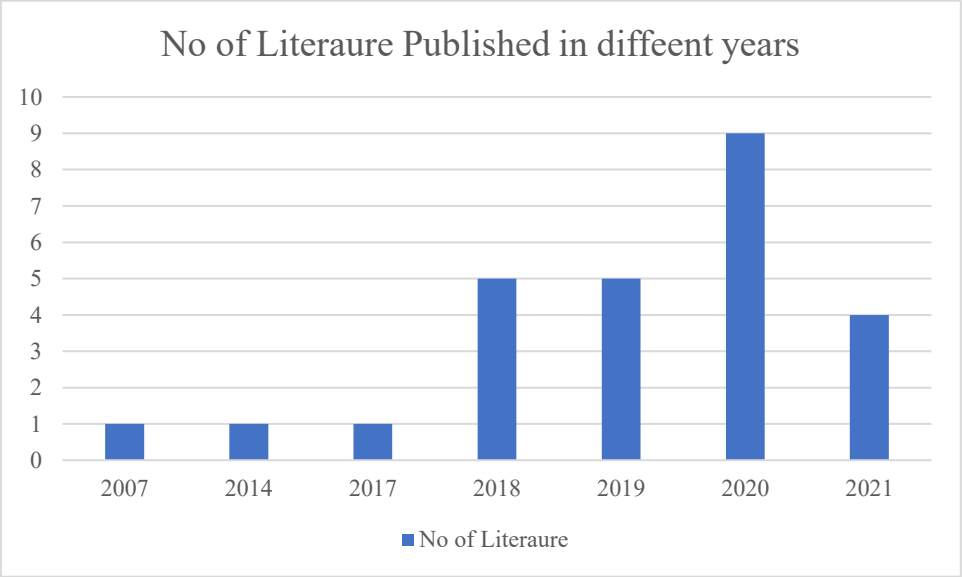

Figure 17. Number of articles published in different years.

4.1.3 Frequency of keywords in abstracts

Figure 18 shows the word cloud representation of most frequent words from the abstracts. The illustration depicts the high proportion of words like circular economy, CE, sustainability, development, human resource, management, environment etc. in the abstracts. Words representing the human side of circular economy are not much frequent in the abstracts indicating the fact that less studies are available so far that discuss the issue of employee wellbeing in circular economy context.

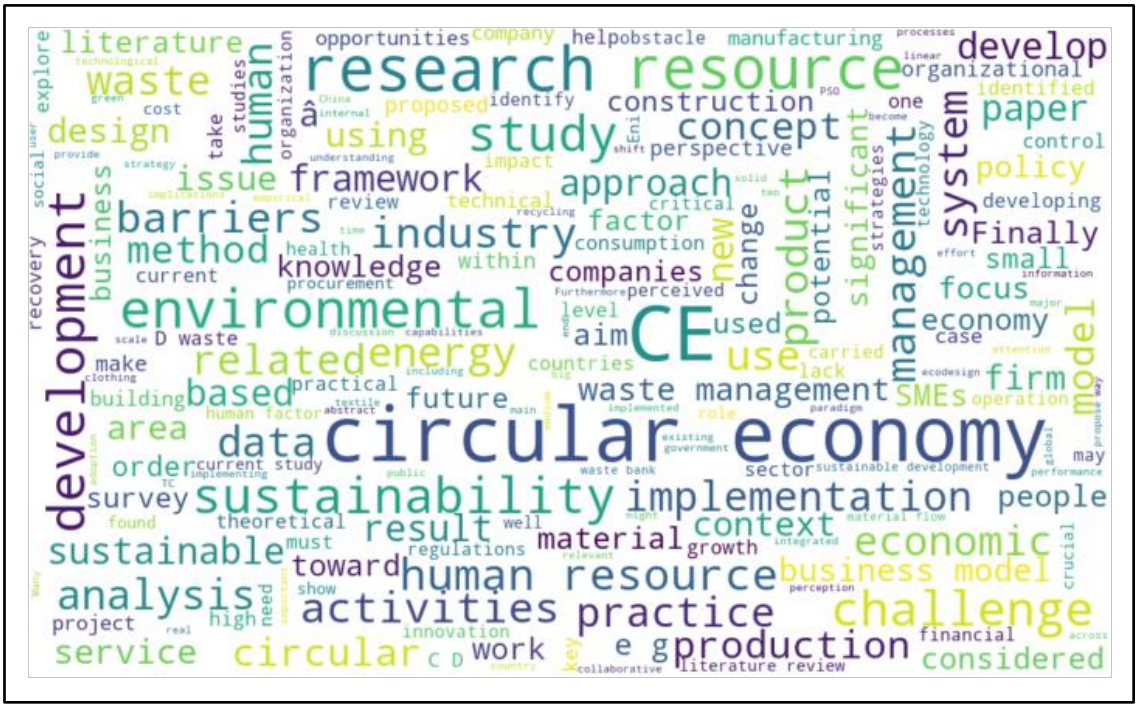

Figure 18. Word cloud from the abstracts of finally screened 26 articles

4.2 HF in different industries in CE context

Ahmad (2019) made effort in identifying the key challenges that IT firm face in implementing ISO 20000: Implications for environmental sustainability and circular economy. It was found that understanding processes and its benefits by the IT support team, justification on short-term and long-term benefits and investing a large amount of money in ITSM tools were the key challenging areas during implementation of ISO 20000 in the case company. To overcome these challenges the interviewees suggested that effective process design, setting organizational priority and top management support are the key factors in addressing other relevant challenges like justification of significant investment, co-operation and co-ordination among IT support teams, proper documentation, and premium customer support. 85% of responses suggest that major challenges can be avoided by strong monitoring, status checking and communication (Ahmad 2019).

Be circular – Be Brussels (Maerckx, 2019) was a construction project competition where focus was on better management. The winning 14 projects applied circular measures on site at a company level. The applied circular measures – Management of human include:

1. Bringing all stakeholders together at the early stage of the project
2. Developing relevant circular knowledge and know-how of the workers.
3. Partnership among the companies to close the loops by promoting collaboration.
4. Company integration for social purpose

It was found that training of the workforce is a key issue to optimize the management of human resources. Half of the wining projects provided specific training for workers to promote reuse practices regarding deconstruction, preparation for reuse, repacking, and effective reuse. The other wining projects already had reuse practices in their companies and contributed to their serving areas (Maerckx, 2019).

Staicu (2021) studied the characteristics of textile and clothing sector in the transition to the circular economy. Human resources was one of the four sections of questionnaires. The questions include typology of the employees, skilled required, difficulties in recruitment and employee training. The result shows that 90% of the employee became productive within the first 90 days from starting job, most of them was unemployed (33%).

4.3 HRM and Employment in CE context

Bag (2021) took exploratory research approach (EFA) and categorized the resources for industry 4.0 adoption to explore its effect on sustainable production and circular economy. It was argued that alignment of human resource process with 4.0 can enable empowerment of employees, digitization of training, cross-functional teamwork and learning which eventually positively influence sustainable production and increase capabilities of circular economy.

Sihvonen's (2018) survey includes human factor: ecological concern of employees more from organizational point of view and less from individual level. The researcher suggests that internal discussion about recycle, recoverable materials, renewables with product durability considerations might add value in improving ecological concern in product development context.

García-Quevedo (2020) in his study showed lack of human resource is one the major barriers to the circular economy in European small and medium sized firms by affecting CE activities. In addition, it was found that lack of human resources- that is lack of technical skills is a major problem for organization seeking to identify and implement new circular business model.

Min (2021) figured out internal and external barriers for Chinese SMEs to adopt CE in their businesses. Internal barriers were classified into resources and capabilities. Regarding human factor context, lack of human resources like academia, professionals, owners, managers, technical specialist are mentioned to be the key internal barriers. SMEs look for short term gain where learning and upskilling about CE takes long time to design and develop CE operations which is not encouraging especially in current competitive economic climates for SMEs. Lack of human creativity mainly due to complex bureaucratic system was addressed as capability barrier (Min, 2021).

4.4 Occupational Safety and Health in CE context

Héry and Malenfer (2020) conducted a strategic foresight study on evaluation of working condition and occupation risks in circular economy context. Circular economy business model will adopt eco-design, industrial and territorial ecology, and functional economy. The very basic of CE is reuse. This secondary raw material will always not be as pure as the first one. Employees working in the processing operations will have to face a wide range of pollutants due to high level of occupational exposure.

The heterogeneity of the recycling materials demands varying design and dimension of installations making it difficult to set defined regulatory process which eventually results malfunctions. Employee health and risks in these cases will be a great concern. For recycle, reuse and remanufacturing, collection of these materials to the facilities will increase transportation. Physical risks are mainly associated with these such as low back pain musculoskeletal disorders, biological, chemical, and mechanical risks (Héry and Malenfer 2020).

5 DISCUSSION

5.1 Employee wellbeing to support future circular economy

Employee wellbeing in human resource management and circular economy have certain similarities which have the potentiality to generate certain synergies. Understanding the common areas between them can certainly enhance the synergies. Both the circular economy and the well-being of employees working in a circular business model can positively affect organizational performance through competitive advantage. Future circular economy and employee wellbeing through green recruitment, selection, training, rewards, assessment of performance, teamwork, and culture are unavoidable in the CE business model. CE business model promotes innovation by better use of resources where the employees are the major resources of an organization. So proactive environment attitudes among the employees trigger the overall performance. The literature studied so far make it obvious that adoption of a circular economy business model is only possible to achieve if adequate support from workplaces is considered and integrated.

Automation in industries is going on at a robust pace. In the future, automation in the circular economy will be one of the popular mediums for sustainable development. A set of specialized skills for the employees in circular operations need to be achieved to go along the process of automation. Working with machines demands a significant level of operational standardization for the safety of the workers. Because of varying industry types, and processing operations in the future circular economy, maintenance operations will be different. As a result, regulations need to be set accordingly for audits to ensure worker health and wellbeing in workplaces.

Another concern is that in the future the manufacturing facilities and recycling facilities may not be in the same places. Experts predict that companies may relocate their recycling facilities in poor or developing countries. Usually, workplace safety, worker health, and employee wellbeing are often blamed to be compromised in these countries. A future circular economy, in this sense, might increase vulnerable conditions in such countries. Not only the human issues but also the environmental issues are predicted to be a concern as different toxic wastes may pollute the surrounding areas taking advantage of poor rules and regulations, and comparatively high corruption in these countries.

To overcome these challenges and to pursue the true effectiveness of circular economy, these issues need to be addressed in advance. In these regards, special employee training to build required skills, specific workplace safety measures, strong policies by the government, and other authorities are highly recommended.

6 CONCLUSIONS

This thesis is focused on employee well-being, occupational safety & health, employment issues, and human resource management in circular economy context. Hence, the effort is made to explore the potential relationship between the circular economy and employee wellbeing especially in the future business trend where the circular model will not only create an advantage to the businesses but also an unavoidable option to survive in this highly competitive world.

The following research questions were set:

RQ1 How are human factors considered in the circular economy context?

RQ2 How are human factors discussed in different major industries along with their scopes in the CE perspective?

The existing literature, however, interestingly and unfortunately, do not present the employee wellbeing or human side in total with respect to the circular economy context.

The knowledge of the circular economy has seen tremendous growth in many areas of literature. The topic is of great interest throughout the world with environmental and economic concerns. On the other hand, employee wellbeing at the organizational level has also been of interest to scholars. Hence CE and employee wellbeing remain largely two separate areas of knowledge. While knowledge of these two fields expanding fast the necessity to relate their potential relationships becomes significant to sustain the future business world through optimum performance and competitive advantage. The important finding of this thesis is that more study is required to effectively address the human issues in the circular economy business model. The current literature indicates the fact that the existing abilities of the employees, their skills, policies for workplace safety, and employee health issues are not in compliance with the progressive trend of CE adoption by different industries.

Since the thesis is based on a theoretical review, it has some certain limitations. Firstly, the studied articles were focused mainly on other issues, only a few sections were relevant to the research questions of this thesis. Secondly, the barriers, challenges and, scopes found in the articles could have been justified using some interviews from the industry employees who are going through the transition process to the circular model of business. Thus, the research results show researchers' views rather than actual visits and interviews. Thirdly,

only one searching engine (Scopus) was used in the research which might have excluded some other valuable studies from other databases.

One of the future research topics could be a quantitative scientific study of this topic. The research could also be based on specific industries within a country addressing socio-economical impacts on a certain region basis. Comparative study of among types industries based on sizes adopting CE can be another scope of further study to know how large scale industries, small scale industries, medium industries, and cottage industries dealing the human issues.

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